

Claims:

1. A process for separating a sperm type from a sperm population by electrophoresis comprising subjecting the sperm population to an electric potential such that a sperm type is separated from a sperm population through an ion-permeable barrier.
- 5 2. The process according to claim 1 wherein the sperm type has a desired characteristic selected from the group consisting of motility, robustness, gender, genetic make-up, morphological normality, fertilizing potential, and combination thereof.
3. The process according to claim 2 wherein the sperm type has fertilizing potential.
- 10 4. The process according to claim 1 wherein the sperm type has an undesired characteristic selected from the group consisting of poor motility, poor morphology, high levels of DNA damage and high levels of reactive oxygen species generation.
5. The process according to any one of claims 1 to 4 comprising:  
providing a sample containing sperm to a sample chamber of electrophoresis  
15 apparatus comprising a first electrolyte chamber; a second electrolyte chamber; a first sample chamber disposed between the first electrolyte chamber and the second electrolyte chamber; a second sample chamber disposed adjacent to the first sample chamber; a first ion-permeable barrier disposed between the first sample chamber and the second sample chamber; a second ion-permeable barrier disposed between  
20 the first electrolyte chamber and the first sample chamber; a third ion-permeable barrier disposed between the second sample chamber and the second electrolyte chamber; and electrodes disposed in the first and second electrolyte chambers; and  
applying an electric potential between the electrodes causing at least one sperm  
type in the first or second sample chamber to move through the first ion-permeable  
25 barrier into the other of the first or second sample chamber.
6. The process according to any one of claims 1 to 5 wherein the sperm sample contains at least two populations of sperm.
7. The process according to any one of claims 1 to 6 wherein the electric potential is applied until at least one sperm type reaches a desired purity.
- 30 8. The process according to any one of claims 1 to 7 wherein one or more ion-permeable barriers are electrophoresis membranes having a characteristic average pore size and pore size distribution.
9. The process according to claim 8 wherein all of the ion-permeable barriers are membranes having a characteristic average pore size and pore size distribution.

10. The process according to any one of claims 5 to 9 wherein the first ion-permeable barrier is a large pore sized membrane.
11. The process according to claim 10 wherein the first ion-permeable barrier is a polycarbonate membrane having a pore size of about 1 to about 10  $\mu\text{m}$ .
- 5 12. The process according to any one of claims 1 to 11 wherein electrophoresis is carried out with a voltage range from 1 to 200 V.
13. The process according to any one of claims 1 to 11 wherein electrophoresis is carried out with an applied current of up to about 75 mA.
14. The process according to any one of claims 1 to 11 wherein electrophoresis is  
10 carried out with a field strength of 1 to 100 V/cm.
15. The process according to claim 14 wherein the field strength is from 16 to 20 V/cm.
16. The process according to any one of claims 1 to 15 wherein electrophoresis is carried out from several seconds to about 15 minutes in an apparatus having a sample volume of about 100  $\mu\text{l}$  to about 4 ml.
- 15 17. The process according to any one of claims 1 to 16 wherein sperm is diluted in buffer having a concentration of between 1 to 100 mM.
18. The process according to any one of claims 1 to 17 wherein sperm concentrations of between about 0.1 and  $250 \times 10^6/\text{ml}$  are processed.
19. The process according to claim 18 wherein sperm concentrations of between  $15 \times$   
20  $10^6/\text{ml}$  and  $140 \times 10^6/\text{ml}$  are processed.
20. The process according to any one of claims 1 to 19 wherein at least about 50% of the sperm type remains viable or substantially unchanged after separation.
21. The process according to claim 21 wherein at least about 60% of the sperm type remains viable or substantially unchanged after separation.
- 25 22. The process according to claim 22 wherein at least about 70% of the sperm type remains viable or substantially unchanged after separation.
23. The process according to claim 23 wherein at least about 80% of the sperm type remains viable or substantially unchanged after separation.
24. The process according to claim 23 wherein at least about 90% of the sperm type  
30 remains viable or substantially unchanged after separation.
25. Use of a sperm type separated by the process according to any one of claims 1 to 24 to fertilize an ovum.
26. Use of a membrane-based electrophoresis apparatus to separate a sperm type from a sperm population.